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EXCURSION GUIDES

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Bryological, Lichenological and Mycological Excursion to Jämtland

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SECTION: TCR

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By *Edvard von Krusenstjerna* and *Rolf Santesson.*

For the most effective use of the few excursion days, a detailed plan prepared a long time in advance seems hardly suitable. The field study of at least certain cryptogamic groups may be highly obstructed by rain and bad weather—a common feature in this region. For that reason we think it best to adapt the programme of each day as much as possibly to the prevailing weather conditions. Instead of a chronological guide we will therefore give a general description of the region to be visited.

In this short survey, only a small number of lichens and bryophytes can be mentioned. We have chosen those of more physiognomical importance, as well as some species of special interest. Unfortunately, we must omit the (non lichenized) fungi as it is very difficult to predict what species will be developed just at that particular time.

Location.

That part of the province of Jämtland which will be visited is situated just north of Lat. 63° N and between Long. 12° and 15° E (See sketch-map, Fig. 4). Its eastern part is a woody highland with an altitude of 300—500 m, which to the west

is connected with a wide, considerably higher fjell district[1] with summits reaching a height of 1 400—1 750 m. This fjell district passes to the south into the broadest part of the Scandes.[1] A few degrees of latitude to the north is the narrowest and lowest part of the fjell-range. With some exceptions, the Swedish-Norwegian boundary almost follows the watershed. At the Norwegian coast c. Lat. 63° N (c. 200—250 km W of the Sw.-Norw. boundary) occurs one of the areas which were unglaciated during the Last Ice Age.

Climate.

On the whole, the climate of Jämtland is not so rigorous as might be expected in view of its latitude and altitude. Climatic data for Östersund, Storlien and Sylarna (cp. Fig. 4) compared with those for Stockholm are given in the diagrams (Fig. 1). The lowest temperature measured at Östersund (after 1880) is —41° C (Febr. 1881 and 1892) and the highest is +33° C (July 1881, June 1882). The low pass (c. 600 m) at Storlien, through which the railway runs, allows the moist west winds to penetrate well to the east giving the region a somewhat oceanic climate. This is clearly shown by the flora and vegetation. To the east, the climate becomes more continental.

The duration of the winter snow in the fjell district is approximately 200—220 days. In the other districts to be visited during the excursion the snow lasts for about 180—200 days.

Geology.

The complicated folding which resulted in the formation of the Scandes began in the late Precambrian period and was

[1] The word fjell is used for a mountain rising above the tree limit. The Scandinavian mountain range is called the Scandes. Cp. E. Ljungner in Bull. Geol. Inst. Uppsala 33: 18, 1949.

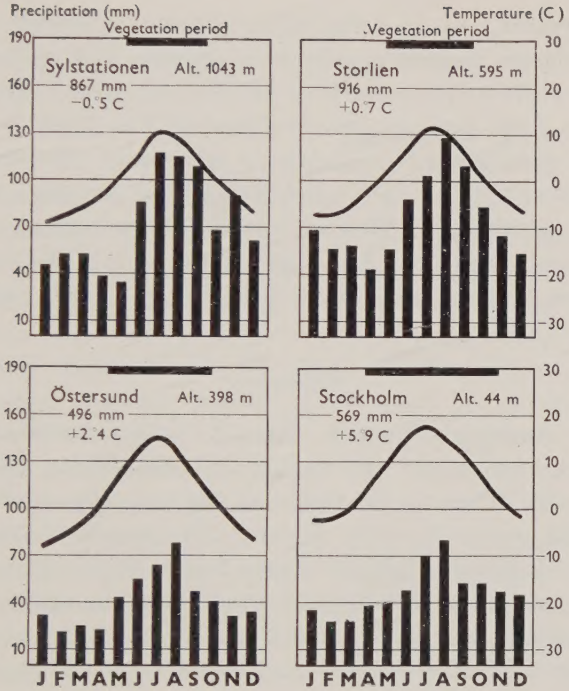


Fig. 1. Temperature (the curve corresponding to the scale on the right hand) and precipitation (the rectangles corresponding to the scale on the left hand) for the different months of the year. Below the names of the stations is given the annual total precipitation and the annual mean temperature. (Redrawn after G. LUNDQVIST, De svenska fjällens natur, 1944, and A. ÅNGSTRÖM, Sveriges klimat, 1946.)

finished in the late Silurian. The fjells are formed from mighty beds of sandy, strongly altered rocks. To the east of the fjells there is a foreland formed from thin beds of, often calcareous, less altered rocks of Cambro-Silurian age. They rest upon the Archaean rocks. Thus, three different districts, which are of great importance as to the vegetation, can be

distinguished. a) The Archaean district situated in the eastern part, formed mainly from granites and gneisses; b) The Cambro-Silurian foreland formed mainly from calcareous rocks and argillaceous shales; c) The fjell district in the west, formed from more or less altered "fjell-schists," called respectively, Seve- and Köli-schists according to the degree of alteration. They are usually rather loose and easily weathered, often rich in mica. In some areas, e. g. Mts. Sylarna and parts of Mt. Åreskutan the fjells consist of a hard amphibolite.

Vegetation.

The Archaean district. Its wide conifer forests, broken by mires and waters, are formed by spruce (*Picea Abies*, the only native *Picea* in Scandinavia) and pine (*Pinus silvestris*, the only native *Pinus* in Scand.). The forests of Jämtland consist of: spruce forests, 57 %; pine forests, 27 %; and decidous forests, mainly birch, 16 %. On the basis of the undergrowth, especially the vegetation of the bottom layer which is of special interest in this connection, three main types of forests can be distinguished:

Lichen-rich forests. The bottom layer is dominated by lichens: *Stereocaulon paschale*, *Cladonia alpestris*, *Cl. rangiferina*, *Cl. silvatica* (*mitis*), *Cl. cornuta*, *Cetraria islandica*, *Nephroma arcticum*. Bryophytes are scarce: *Polytrichum juniperinum*, *P. piliferum*, and sometimes *Dicranium robustum*, *D. undulatum*, *D. fuscescens* and *Pleurozium Schreberi*. The field layer is sparse, formed mainly by dwarf-shrubs: *Calluna vulgaris*, *Empetrum hermaphroditum*, *Vaccinium Vitis-idaea*, *Arctostaphylos uva-ursi*. These forests are most often open pine forests on dry and sandy soils. On boulders, *Parmelia centrifuga* forms its characteristic designs in these pine-heaths. Among

the epiphytic lichens on the pines, *Alectoria jubata* usually dominates; *A. Fremontii*, *A. simplicior*, and *A. nidulifera* are often seen (cp. AHLNER 1948).

"*Hylocomium*-rich" forests. The bottom layer is well developed and dominated by bryophytes: *Pleurozium Schreberi*, *Hylocomium splendens*, *Dicranum fuscescens*, *D. undulatum*, *D. scoparium*, *Barbilophozia lycopodioides*, *Ptilium crista-castrensis*, with a few lichens intermixed, i. a. *Cladonia gracilis*, *Cl. silvatica*, *Peltigera aphthosa*. The field layer is usually well developed, and may be formed by dominating dwarf-shrubs: *Vaccinium Myrtillus*, *V. Vitis-idaea*, *Calluna vulgaris*, with *Deschampsia flexuosa*, *Melampyrum pratense*, etc., or by communities of *Lastrea* (*Thelypteris*) *Dryopteris*, the two *Vaccinium* species, *Trientalis europaea*, etc. Sometimes a "tall herb" vegetation of *Lactuca alpina*, *Aconitum septentrionale* etc., make the bottom layer more sparse; it is composed in part by other species, e. g. *Rhytidiadelphus triquetrus*, *Hylocomium umbratum*, *Rhodobryum roseum*, *Cirriphyllum piliferum*, *Mnium* spp., *Plagiochila asplenioides*. These forests are most often dark spruce forests, mainly on less dry, fine soils. The dominating epiphytes on the spruces are *Parmelia physodes*, *Cetraria glauca*, and *Alectoria jubata*. Sometimes we find *A. sarmentosa*. On *Salix* and *Populus tremula* in the forests, *Ramalina landroensis* is often seen, on *Populus* also epiphytic mosses, e. g. *Stroemia obtusifolia*.

Sphagnum-Polytrichum-rich forests ("swamp-forests"). The bryophytes of the *Hylocomium*-rich forest types are usually found here together with various Sphagna, i. a. *Sph. Girgensohnii*, *Sph. parvifolium*, and *Sph. robustum*, and *Polytrichum commune*. Spruce forests on wet ground show sometimes abundant *Equisetum silvaticum*, sometimes *Rubus Chamaemorus*, etc.

Steep rocks are rather common in the hilly Archaean district. They have a very varied and rich flora of bryophytes and lichens, i. a. *Andreaea rupestris*, *Cynodontium strumiferum*, *Dicranum scoparium*, *Grimmia ovalis*, *Gr. torquata*, *Paraleucobryum longifolium*, *Plagiothecium denticulatum*, *Sphenolobus minutus*, *Tritomaria quinquedentata*, and (in caves) *Neckera oligocarpa*; — *Umbilicaria hyperborea*, *U. proboscidea*, *Lecanora caesiocinerea*, *L. cinerea*, *Lecidea macrocarpa*, *Parmelia saxatilis*, *Rhizocarpon geographicum*, *Sphaerophorus globosus*.

The Cambro-Silurian foreland. In Jämtland, the Cambro-Silurian foreland is much wider than in other parts of the eastern side of the fjell range. Lake Storsjön (alt. 292 m) forms the centre in this district with its relatively extensive areas of cultivated ground. Here Östersund (20 000 inhab.) is situated, the only town of the province. The topography of the Cambro-Silurian foreland is usually more flat and less rough than in the Archaean district.

However, even in this Foreland the conifer forests dominate. The spruce is most abundant but forests consisting of *Betula pubescens* and *B. verrucosa* also occur. The calciferous soils characteristic of this district give the vegetation its special features.

The mires (this section written by H. Sjörs) cover a large percentage of the Foreland. Slightly sloping fens, often with hummocks of *Sphagnum fuscum*, are prevailing. In their wet open areas grow calciphilous *Cyperaceae* communities, with a bottom layer of *Scorpidium scorpioides*, *Sc. trifarium*, *Cinclidium stygium*, *Meesia triquetra*, *Drepanocladus intermedius*, *D. badius*, *Campylium stellatum*, *Catoscopium nigritum*, *Paludella squarrosa*, *Tomenthypnum nitens*, *Sphagnum Warnstorfianum*, etc. The flora of fens watered by springs and often forming

calcareous tufa is still richer and includes numerous vascular plants and a few bryophytes, esp. *Cratoneurum* spp. and *Philonotis calcarea*, in addition to most of the species mentioned.

Outside the continuous Cambro-Silurian foreland there are in the fjell district NW of Åreskutan and W of Storlien small Cambro-Silurian areas with pronounced calciphilous vegetation.

The fjell district. In this district we can distinguish between three different regions which depend upon the altitude: 1. The conifer forest region, 2. The birch forest region (Regio subalpina), and 3. The alpine region.

1. *The conifer forest region* is a direct continuation of the conifer forests of the other districts. It reaches in the eastern parts an altitude of about 800 m, in the western about 650 m. During the excursion we shall meet with two rather different types of these forests.

The spruce forests of the southern slope of Mt. Åreskutan are rich in tall-herbs (*Lactuca alpina*, *Aconitum septentrionale*, *Geranium silvaticum*, *Crepis paludosa*) especially in the valleys of the rivulets. On the whole they are rich in species in the field layer. The composition of the bottom layer depends largely on the humidity of the ground. On dry places, the Hylocomia dominate, sometimes *Mnium spinosum* is abundant. On wet places we find *Mnium Seligeri*, *Calliergonella cuspidata* etc. (cp. v. Krusenstjerna 1942).

In the valleys, *Alnus incana* (with i. a. *Lecidea euphoraea*) sometimes forms small low grows.

In the ravine formed by the rivulet Mörviksbäcken, we find on the wet schistaceous walls a number of bryophytes, *Amphidium Mougeotii*, *Distichium capillaceum*, *Plagiopus Oederi*,

Barbula recurvirostris, and various Mnia together with lichens such as *Solorina saccata*, *S. spongiosa*, *Peltigera venosa*, *P. spuria*, *Baeomyces roseus*, etc. On the shores of the rivulet *Saxifraga aizoides* forms communities often with a bottom layer of *Cratoneurum decipiens* and *Philonotis calcarea*.

On stone blocks in the lowest part of this forest, there occur carpets of *Pseudoleskea incurva* or *Rhacomitrium microcarpum* together with *Dicranoweisia crispula*. *Entodon orthocarpus* grows in dry meadows in the upper part of the spruce forest region of Mörvikshummeln.

The conifer forests between Lake Ånnsjön and the Norwegian boundary show distinctly oceanic features. W of Storlien we often find *Plagiothecium undulatum* (sometimes c. fr.), *Rhytidiadelphus loreus*, *Anastrepta orcadensis*, and even *Lepidozia trichocladus*, and the fern *Blechnum spicant*.

The epiphytic flora is rich on spruce, and especially *Cetraria norvegica* and *Cavernularia Hultenii* must be observed. The latter is confined almost entirely to spruce and is known as yet only from oceanic areas in Scandinavia and Alaska (Ahlner 1948 p. 33 and 220). *Cetraria glauca* is very often fertile here and is infected by *Abrothallus Parmeliarum* and *Nesolechia oxyspora*. *Alectoria sarmentosa*, *Parmelia obscurata*, *P. tubulosa*, *Ochrolechia tartarea* (*androgyna*) may also be mentioned.

A very interesting cryptogamic flora is found at the waterfalls of Handöl (the total height of the falls is c. 110 m, alt. 640—530 m s. m.).

The following species are found on the most frequently submerged rocks: *Jonaspis cyanocarpa*, *Verrucaria* spp., *Placopsis gelida*, *Lecanora lacustris*, etc.; — *Blindia acuta*, *Brachythecium plumosum*, and *Hygrophynum* sp.

On occasionally submerged rocks grow *Rhizocarpon badioatrum*, *Lecidea panaeola*, *L. paupercula*, *Umbilicaria deusta*, etc.;

Eremonotus microcarpus, *Hygrobiella laxifolia*, *Schistidium alpicola*, etc.

A great number of bryophytes and lichens occur on rocks which are wetted by the spray from the falls and in rock-caves: *Stereocaulon denudatum*, *St. glareosum*, *Pannaria pezizoides*, *Psoroma hypnorum*, *Biatorella campestris*, etc.; — *Mnium* is represented by several species, i. a. *Mn. orthorrhynchum*, *Mn. hymenophyllum*, *Mn. hymenophylloides*, furthermore *Ditrichum flexuosum* (f. *longifolia* Zett.), *Tortella tortuosa*, *Myurella julacea*, *Encalypta* spp., *Meesia trichodes*, *Blepharostoma trichophyllum*, *Scapania cuspiduligera*, *Sc. subalpina*, *Odontoschisma Macounii*, etc.

On drier rocks, *Rhytidium rugosum* sometimes dominates, while all the 13 *Peltigera* species known from Sweden have been seen around the falls!

The low spruces and birchs on the slopes at the falls have a rich epiphytic lichen flora, *Parmelia austerodes*, *P. obscurata*, *Pannaria rubiginosa*, *P. pityrea*, *Lobaria scrobiculata* (sometimes carrying *Rinodina soredicola*), *L. Hallii* (very sparse), etc. Several of these species are of oceanic type (cp. Du Rietz, Sv. Bot. Tidskr. 8: 272, 1914, Degelius 1935, and Ahlner 1948).

The ravine just N. of Storlien has a cryptogamic vegetation rather similar to that of the drier places at the falls of Handöl. Here we will find, i. a., *Frullania Tamarisci*, *Mylia Taylorii*, and *Ulota Drummondii*; — *Thelocarpon epibolum*, *Cladonia turgida*, *Nephroma resupinatum*, *N. laevigatum*, *N. parile*, etc.

2. *The subalpine birch forest region.* Deciduous forests formed by *Betula tortuosa* extend from the conifer forest region to the forestless alpine region. There is no sharp limit between the conifer and the birch forest. The tree limit is

Fig. 2. Subalpine birch forest NE of Storulvåstugan. On the trunks the lower limit of the darkbrown *Parmelia olivacea* - communities marks approximately the depth of the winter snow (at this place about 1.5 m). — Photo R. Santesson, August 7, 1949.

usually formed by the birch, but sometimes law spruces may grow together with the birch at the tree limit and may even grow higher up than the birch. The altitude of the wood limit varies from c. 700 m to c. 900 m. On Mt. Skurdalshöjden, S slope, c. 720 m; Mt. Åreskutan, S slope, c. 820 m; Mt. Snasahögarna, N slope, c. 830 m; Mt. Blåhammarkläppen, N slope, c. 850 m.

The subalpine birch forests are mainly heath forests with *Empetrum hermaphroditum* and *Vaccinium Myrtillus* dominating, and with *Cornus suecica* abundant. The bryophyte vegetation corresponds to that of the conifer forest with the same

Fig. 3. The Sylarna fjells seen from NE. From left to right; Mt. Storsola, Mt. Templet, Mt. Slottet, Mt. Storsylen (1762 m) and Mt. Lillsylen. In the foreground the tourist station Nya Sylstationen (1 043 m). — Photo N. THOMASSON.

humidity. The most conspicuous lichens are *Nephroma arcticum*, *Peltigera scabrosa*, *Cladonia bellidiflora*, *Stereocaulon paschale*, etc.

An often very striking limit is seen on the trunks of the birchs: the lower limit of the darkbrown *Parmelia olivacea*, which indicates approximately the highest level of the winter snow (cp. NORDHAGEN 1927, p. 98). Together with *P. olivacea* we find, above this line, *P. physodes*, *P. sulcata*, *Alectoria simplicior*, *A. jubata*, *Cetraria glauca*, *C. chlorophylla*, etc. Below the line the bases of the birchs are often covered by *Parmeliopsis ambigua* and *P. hyperopta*, frequently together with various *Cladonia* spp. (Fig. 2).

On the tops of low spruces growing in the tree limit, above the birch-forest, *Tholurna dissimilis* is found at some points

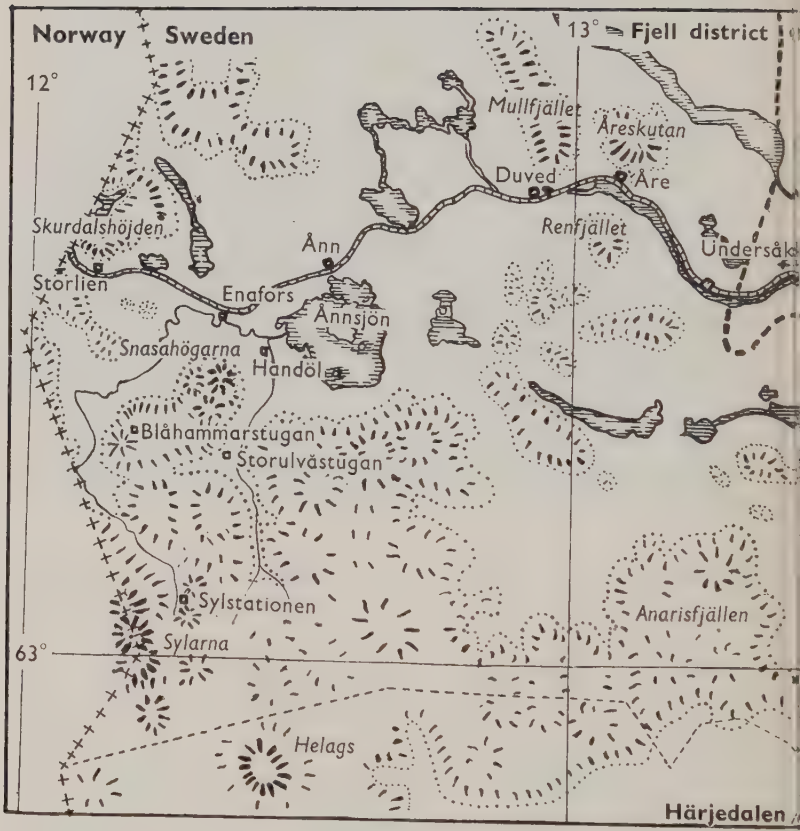
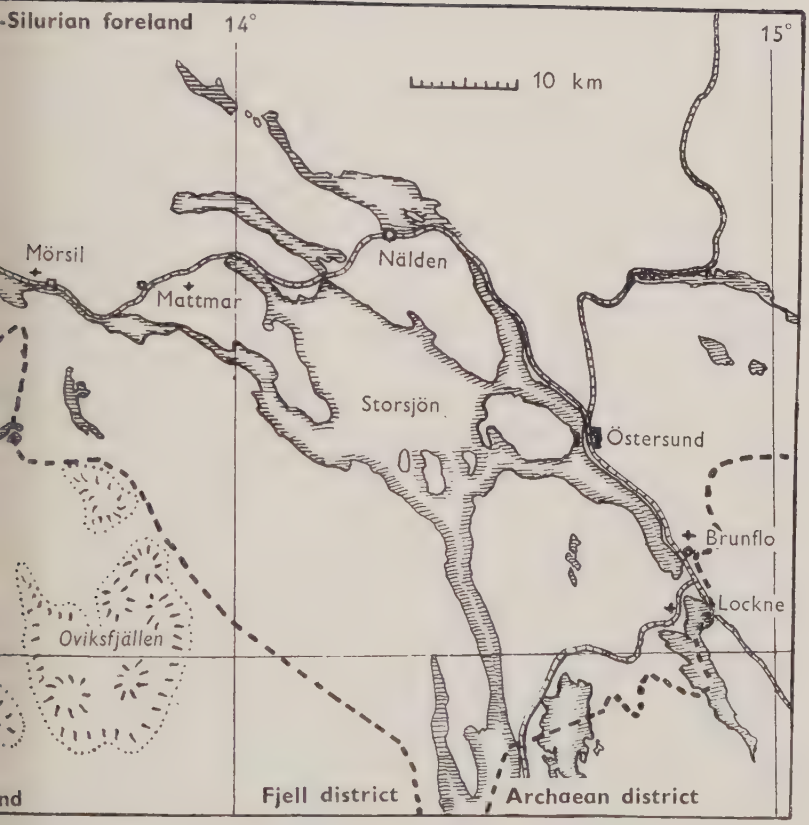


Fig. 4. Sketch-map of the excursion area. To the right a small part of the fjell district, delimited by the thick



aean district, around Storsjön the Cambro-Silurian foreland and to the left ines. Dotted lines represent wood limit.

which will be visited during the excursion (Mt. Totthummeln, Mt. Skurdalshöjden, S slope, Mt. Stenfjeld, SE slope). As yet, this lichen is known with certainty only from Fennoscandia (Ahlner 1948).

3. *The alpine region.* The distribution of this region is seen from the sketch-map (Fig. 4). In Scandinavia it is usually divided into three belts: the low alpine belt, the middle alpine belt and the high alpine belt. The first is characterized by the dominance of dwarfscrub heaths. The disappearing of *Vaccinium Myrtillus* marks the upper limit of this belt (cp. Du Rietz 1942), c. 1 325—1 375 m (sometimes up to 1 465 m) (Kilander, Sv. Bot. Tidskr. 44: 167—193, 1950). The middle alpine belt is characterized by grass-heaths. In the fjells of Jämtland only a small part of Mt. Sylarna (from c. 1 650 m) reaches the high alpine belt, where plants other than lichens and mosses are very scarce.

To give some idea of the bryophyte- and lichen-flora of the low alpine belt, we will mention a few habitats and their most common species.

a) Willow-shrubs, formed by *Salix glauca*, *S. lanata*, *S. lapponum*, etc., are often widely distributed in flat valleys and on wet slopes in the lower part of the belt. Important herbs: *Bartsia alpina*, *Pedicularis Sceptrum-Carolinum*. Bryophytes: *Calliergon stramineum*, *Mnium pseudopunctatum*, *Polytrichum commune*, *Sphagnum centrale*, *Sph. Girgensohnii*. Lichens (epiphytic): *Cetraria juniperina*, *Parmelia olivacea*.

b) Dwarf-shrub heaths. These heaths have a very different composition, depending on calcareous or non-calcareous ground, on the duration of the snow cover and on other factors.

Salix herbacea heaths, on late-snow areas ("snow bed"). *Gnaphalium supinum*, *Sibbaldia procumbens*, *Carex Lachenalii*,

C. Bigelowii, *Cassiope hypnoides* etc. Bryophytes: *Kiaeria* spp., *Conostomum tetragonum*, *Oligotrichum incurvum*, *Polytrichum alpinum*, *P. norvegicum*, *Webera commutata*, *Anthelia Juratzkana*, *Gymnomitrium* spp., *Lophozia alpestris*, *Pleurocladula albescens*. Lichens: *Cetraria Delisei*, *Cladonia elongata*, *Cl. bellidiflora*, *Ochrolechia frigida*, *Solorina crocea*, *Lecidea assimilata*, *Stereocaulon alpinum*, on stones *Lecanora alpina* and *L. polytropa*.

Vaccinium Myrtillus heaths, on areas sheltered by winter snow, rather early snow-free. *Phyllodoce coerulea*, *Deschampsia flexuosa*, *Solidago virgaurea*, *Trientalis europaea*, *Pedicularis lapponica*, *Lycopodium alpinum*, etc. Bryophytes: *Hylocomium splendens*, *Pleurozium Schreberi*, *Dicranum fuscescens*, *Barbilophozia lycopodioides*, *Orthocaulis Kunzeanus*. Lichens: *Nephroma arcticum*, *Cetraria islandica*, *Cladonia bellidiflora*, *Cl. silvatica* (*mitis*), *Peltigera* spp., *Lecidea granulosa*, etc.

Betula nana heaths are most striking on less sheltered areas, but are found in other areas too. *Empetrum hermaphroditum*, *Deschampsia flexuosa*. Bryophytes: *Pleurozium Schreberi*, *Hylocomium splendens*, *Ptilidium ciliare*. Lichens: *Cetraria islandica*, *C. nivalis*, *Cladonia* spp., *Stereocaulon paschale*.

Empetrum hermaphroditum heaths on more exposed areas, early snow-free. *Arctostaphylos alpina*, *Betula nana*, *Vaccinium Vitis-idaea*, *Lycopodium Selago*. Bryophytes: *Rhacomitrium lanuginosum*, *Dicranum fuscescens*, *Polytrichum alpinum*. Lichens: *Cladonia silvatica* (*mitis*), *Cl. rangiferina*, *Cetraria cucullata*, *Ochrolechia frigida*, *Stereocaulon paschale*.

Loiseleuria procumbens heaths (mixed with *Empetrum* on less exposed areas, and with *Diapensia lapponica* on very exposed areas) occurs on exposed, wind-eroded hills, very early snow-free. Bryophyte: *Rhacomitrium lanuginosum*. Lichens: *Cetraria nivalis*, *C. cucullata*, *Cornicularia divergens*,

Alectoria nigricans, *A. pubescens*, *A. ochroleuca*, *A. sarmentosa* v. *cincinnata*, *Thamnolia vermicularis*, *Pertusaria dactylina*, *P. oculata*, *Ochrolechia frigida*, *Sphaerophorus globosus*. On dead parts of the *Diapensia* cushions *Lecidea Diapensiae*.

Dryas octopetala heaths, on calcareous ground, correspond to the *Empetrum* and *Vaccinium Myrtillus* heaths on non-calcareous ground (will be seen i. a. on Mt. Stenfjeld). *Salix reticulata*, *Thalictrum alpinum*, *Carex rupestris*, *Trisetum spicatum*, *Chamorchis alpina*, *Pedicularis Oederi*, *Polygonum viviparum*. Bryophytes: *Hylocomium pyrenaicum*, *Aulacomnium turgidum*, etc. Lichens: *Cetraria cucullata*, *C. nivalis*, *C. juniperina* f. *terrestris*, *Lecidea decipiens*, *Solorina saccata*, *Pertusaria bryontha*, *Candelariella placodizans*, *Stereocaulon glareosum*, etc.

c) Grass-heaths. *Deschampsia flexuosa* - *Anthoxanthum odoratum* and *Nardus stricta* heaths on late snow-free sheltered areas. *Lycopodium alpinum*, *Alchemilla alpina*, *Luzula spicata*. Bryophytes: *Dicranum fuscescens*, *Polytrichum alpinum*, *Lophozia alpestris*, *Barbilophozia lycopodioides*. Lichens: *Cladonia elongata*, *Cl. bellidiflora*.

Juncus trifidus heaths on very windexposed areas. Bryophytes: *Rhacomitrium lanuginosum*. Lichens (mainly on the naked stones): *Alectoria pubescens*, *Umbilicaria proboscidea*, *U. cylindrica*, *Cetraria hepatizon*.

d) Mires (this section is written by H. Sjörs). Bogs or mosses mainly built up by *Sphagnum fuscum* occur very locally in the low alpine belt, but are extensive in the conifer forest region, esp. around Enafors and Lake Ånnsjön. Most mires in the fjell district are *Cyperaceae* (and *Molinia*) fens, often strongly sloping and with trickling water. In the bottom layer the acid fens are dominated by *Sphagna* (e. g. *Sph. compactum*, *Sph. Lindbergii*), or by *Drepanocaldus fluitans* or

Calliergon stramineum: the less acid fens mostly by other bryophytes (e. g. *Calliergon sarmentosum*, *Drepanocladus revolvens*, *Dr. purpurascens*, *Dr. badius*, *Paludella squarrosa*, *Oncophorus Wahlenbergii*, *Odontoschisama elongatum*, *Scapania* spp.): in circumneutral fens, often on more or less calcareous soil, *Scorpidium scorpioides*, *Drepanocladus intermedius*, *Campylium stellatum*, *Tomenthypnum nitens*, etc., are prevailing, and on strongly calcareous soil also, i. a., species of *Cratoneurum*.

e) Areas covered by boulders are abundant in the upper part of the low alpine belt, dominating completely at higher altitudes. Higher plants scarce between the boulders: *Cardamine bellidiflora*, *Luzula confusa*, etc. Bryophytes: *Andreaea rupestris*, *Rhacomitrium microcarpum*, *Rh. lanuginosum*, *Dicranoweisia crispula*, *Temnoma setiformis*. Lichens: *Umbilicaria cylindrica*, *U. hyperborea*, *Lecanora badia*, *Lecidea flavocoerulescens*, *Parmelia centrifuga*, *P. incurva*, *P. intestiniformis*, *Rhizocarpon geographicum*, *Rh. chionophilum*, *Rh. oreites*.

Big solitary boulders may frequently be visited by birds and have an ornithocoprophilous lichen-vegetation on the tops: *Xanthoria candelaria*, *Ramalina polymorpha*, *R. capitata*, *Rinodia cacuminum*, *Physcia tribacea*, *Umbilicaria arctica*, etc.

f) Steep rocks with clefts and niches are rich in bryophytes and lichens. Of higher plants may be mentioned: *Saxifraga cernua*, *S. nivalis* and (on calcareous rocks in W) *S. Cotyledon*. (The species last mentioned is protected in Sweden!) Bryophytes: In moist spots *Aulacomnium turgidum*, *Andreaea* spp., *Arctoa fulvella*, *Bazzania tricrenata*, *Drepanocladus purpurascens*, etc., in drier localities *Grimmia funalis*, *Gr. torquata*, *Mnium Blyttii*, *Orthothecium chryseum*, etc. Lichens: *Umbilicaria vellea*, *U. rigida*, *U. decussata*, *Rhizocarpon chionophilum*, *Stereocaulon denudatum*, *Acarospora chlorophana*, *Buellia pulchella*, *Caloplaca elegans*, etc.

In caves and similar sheltered places, we may find *Webera cruda*, and (at high altitudes in Mt. Sylarna) *Grimmia incurva*.

Steep seepage, especially at high altitudes, are overgrown by dark mosses, *Andreaea Blyttii*, *A. nivalis*, *A. obovata*, *Arctoa fulvella*, various hepatics, i. a. *Gymnomitrium concinnatum*, and lichens, i. a. *Ephebe lanata* and *Phylliscum Demangeonii*.

g) Rivulets. At the rivulets the "snow-bed" vegetation is often well-developed (*Salix herbacea* heath etc.). Among plants characteristic of these wet localities may be mentioned: *Athyrium alpestre*, *Epilobium anagallidifolium*, *E. Hornemannii*, *Sedum Rosea*, *Saxifraga aizoides*, *S. stellaris*, *Viola biflora*, *Koenigia islandica*. Bryophytes: *Anisothecium squarrosum*, *Calliergon sarmentosum*, *Philonotis* spp., *Hygrohypnum* spp., *Jungermania cordifolia*, *Marsupella emarginata*, *M. sphacelata*, *Scapania subalpina*, *Sc. uliginosa*. Lichens (on stones in the rivulets): *Jonaspis suaveolens*, *J. odora*, *Verrucaria Leightonii*, *Staurothele fuscocuprea*, *Lecanora alpina*, *Rhizocarpon badioatrum*. Among rarer species may be mentioned (Mts. Sylarna): *Dermatocarpon rivulorum* and *Staurothele clopimoides*.

On steep earth-slopes at the rivulets we often find éphemeral communities of *Anisothecium crispum*, *Pogonatum urnigerum*, *Polytrichum alpinum*, and *Webera* spp. Lichens: *Pannaria pezizoides*, *Peltigera venosa*, *Solorina crocea*, the latter very often infected by *Rhagadostoma lichenicola* and *Metasphaeria decolorans*.

In the middle alpine belt, the dwarf-shrub heaths are rare, certain graminids dominating: *Juncus trifidus*, *Luzula arcuata*, *Carex Bigelowii*, *Deschampsia alpina*, etc. *Ranunculus glacialis* is a conspicuous plant. Areas covered by blocks of stones are very abundant, as are rocky steeps.

The bryophyte flora here is poorer in species than that of the low alpine belt. It is formed mainly by the same species

which occur on rocky steeps in the latter. *Andreaea Blyttii* and *Grimmia incurva* must be concidered as prominent for the middle alpine belt.

Most of the lichens found in the heaths of the low alpine belt are found also in the middle alpine belt though some are not so common. The lichen communities on the blocks of stone are very well-developed. The *Rhizocarpon chionophilum* - communities occur on blocks which are early snow-free; the *Lecidea flavocoerulescens* - communities on later snow-free blocks. Near permanent snow-fields *Lecanora polytropa* and (on *Andreaea* tufts) *L. leptacina, Pyrenopsis pulvinata*, etc.

In the high alpine belt vascular plants are very rare, only scattered specimens of *Ranunculus glacialis, Luzula arcuata, Lycopodium Selago* and some others being found. Rocks and blocks of stone carry the bryophyte and lichen vegetation, which is the characteristic vegetation of this region.

On the summit of Mt. Storsylen (1 762 m) the following species have been seen: Bryophytes: *Andreaea nivalis, A. rupestris, Kiaeria Starkei, Rhacomitrium lanuginosum, Webera nutans, Temnoma setiformis.* Lichens: *Alectoria nigricans, A. ochroleuca, Cetraria commixta, C. crispa, C. nivalis, Cladonia alpicola* (Degelius), *Cl. coccifera, Cl. gracilis, Cl. pyxidata, Cl. silvatica* (*mitis*), *Cornicularia divergens, Crocynia neglecta, Haematomma ventosum, Lecanora alpina, L. chlorophaeodes* (Degelius), *L. leptacina, L. Myrinii, L. intricata, L. polytropa, Lecidea armeniaca, L. demissa, L. flavocoerulescens, L. pantherina, Ochrolechia frigida, Parmelia alpicola, P. centrifuga, P. intestiniformis, P. omphalodes, Rhizocarpon chionophilum, Rh. geographicum, Rh. oreites, Solorina saccata, Sphaerophorus fragilis, Sph. globosus* (Degelius), *Stereocaulon alpinum, St. denudatum, Thamnolia vermicularis, Umbilicaria arctica, U. cylindrica, U. deusta, U. hyperborea, U. proboscidea, U. vellea.*

Literature.

Concerning the nomenclature of Scandinavian plants cp.: Förteckning över Skandinaviens växter. 1. Kärlväxter, 2. Mossor, 3. Alger, 4. Lavar. Lund 1941 and 1936—37. (Lists of names of Scandinavian (1) vascular plants, (2) bryophytes, (3) algae, some groups, and (4) lichens.)

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Programme.

We leave Stockholm by train for Östersund. Near Krylbo (c. 160 km from Stockholm) we pass the "*limes norrlandicus*," one of the most important phytogeographical limits in Sweden (cp. M. Fries, Sv. Bot. tidskr. 42: 51—69, 1948). The general features of the landscape change from a rather flat lowland

to a higher, hilly, less cultivated wooded landscape. The monotonous conifer forests which we pass are sometimes broken by wide mires.

We shall devote the first field-day to the forests SE of Östersund, going by bus from Östersund to Brunflo and Lockne, with stops at the calcareous fens at Odensala, the spruce forests at Fårskinns-berget, etc.

In the morning of the following day we shall take the train from Östersund to Åre (alt. c. 380 m), spend the day on the southern slope of Mt. Åreskutan (summit 1 367 m) with Mt. Totthummeln (826 m), the ravine of Mörviksbäcken etc. At night we shall go by train from Åre to Storlien.

Four days will be devoted to the vegetation and flora around Storlien (alt. 610 m, 3 km from the Norwegian boundary), i. a. to Mt. Skurdalshöjden (839 m), Mts. Skurdalsbergen (822 m), Mt. Stenfjeldet (930 m, calciphilous flora), Skurdalssjön (692 m), Visjön (588 m) and the waterfalls at Handöl (c. 18 km ESE of Storlien, train to Enafors, from there by automobile to Handöl).

For those who wish to see the flora of higher altitudes and who are trained for longer mountain tramps, a 6-days trip to the fjells of Sylarna will be made. First day on foot (c. 19 km) from Storlien to the tourist hut Blåhammarstugan (alt. 1 085 m, NE of the summit of Mt. Blåhammarkläppen), passing Storvallen, Rundhögen and Sevedholm. Next day on foot (c. 20 km) over V Endalshöjden to the tourist-station Nya Sylstationen (alt. 1 043 m, 4.5 km NE of Mt. Storsylen). During three days we will have Sylstationen as our base and climb Mt. Storsylen (1 762 m), study the flora of Mt. Storsola (1 710 m), Mt. Knippen (1 268 m), the valley of Ekorrdörren, etc. We return from Sylstationen on foot (c. 16 km) to the hut Storulvåstugan (alt. c. 720 m) and on

the next day on foot (c. 12 km) to Handöl and by automobile (c. 8 km) to Enafors, or if the weather and our condition permit, the somewhat longer way over the summit of Mts. Snasahögarna (Mt. Storsnasen 1 464 m) directly to Enafors. On the same night we leave by train for Storlien where the excursion terminates.

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